Analysis of the ECG Signal Using SVD-Based Parametric Modelling Technique

Authors(s): Hamza Baali, Momoh-Jimoh E Salami, Rini Akmeliawati, Abiodun Musa Aibinu

Abstract

A new parametric modeling technique for the analysis of the ECG signal is presented in this paper. This approach involves the projection of the excitation signal on the right eigenvectors of the impulse response matrix of the LPC filter. Each projected value is then weighted by the corresponding singular value, leading to an approximated sum of exponentially damped sinusoids (EDS). A two-stage procedure is then used to estimate the EDS model parameters. Prony's algorithm is first used to obtain initial estimates of the model, while the Gauss-Newton method is applied to solve the non-linear least-square optimisation problem. The performance of the proposed model is evaluated on abnormal clinical ECG data selected from the MIT-BIH database using objective measures of distortion. A good compression ratio per beat has been obtained using the proposed algorithm which is quite satisfactory when compared to other techniques.

Keywords: Exponentially damped sinusoids, ECG, Linear Prediction, Nonlinear fitting, Parametric modeling, Prony method